

**Directions: Put all answers on the paper provided. Please number the questions and each of its parts. Be sure that your answers are detailed, unambiguous, and complete. Ask for clarification if you have any difficulty interpreting a question or the information provided.**

1. (35 points) In a 1997 study,<sup>1</sup> David Card examined the role of regulatory reform in the airline industry on the wages of airline workers. He uses wage data and personal characteristics of workers inside and outside of the airline industry.

a. In one regression, Card regresses the log of hourly wages on an intercept and a dummy indicating whether the worker is in the airline industry. The coefficient on the airline dummy was .458 and the standard error on the coefficient was .004. What is the economic interpretation of the coefficient .458?

b. In a second regression, Card regresses the hourly wage on the airline dummy and adds controls for worker education and experience. The coefficient on the airline dummy drops from .458 to .310. Why do you think the coefficient on the airline dummy fell? Be sure to give details on the relationship between relevant variables that would cause the coefficient to move in the observed direction. Also, provide the econometric basis for your conclusion.

Suppose that in Card's data, experience is measured with error. Moreover, suppose that men, on average, have more experience than women.

c. If the Card regression in (b) includes a dummy variable indicating whether a person is male along with the experience variable, how will the measurement error affect the coefficient on experience? Justify your answer.

d. how will the measurement error in the experience variable affect the coefficient on the male dummy? Justify your answer.

Card was interested in how deregulation of the airline industry affected the wages of airline workers relative to the rest of the population. To test for the effect of deregulation, he had data for years before and after deregulation occurred and defined a dummy variable (call it DEREK) that was unity after deregulation and zero before.

e. Explain how Card could test whether the DEREK period caused airline wages to fall relative to other workers' wages. **Be sure to define any additional variables that would have to be created, the regression that would have to be estimated, and the appropriate test statistic for the null hypothesis.**

f. Explain how Card could test whether the DEREK period caused the wages of airline pilots to fall more than wages of other airline workers. **Be sure to define any additional variables that would have to be created, the regression that would have to be estimated, and the appropriate test statistic for the null hypothesis.**

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<sup>1</sup> David Card, "Deregulation and Labor Earnings in the Airline Industry," in *Regulatory Reform and Labor Markets*, edited by James Peoples, Kluwer Publishers 1997.

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2. (10 points total) A recent study of drug enforcement policy,<sup>2</sup> the determinants of drug arrests in U.S. cities were examined. The data used in the analysis came from 24 cities observed annually between 1987 and 1993. **The dependent variable in the regression was the ratio of drug arrests to total arrests (DA/TA).** In the analysis of drug arrests, dummy variables were included for 23 of the 24 cities in the sample, along with other controls for the demographics of the cities. Using **Atlanta GA as the reference group**, a sampling of coefficients on the city dummies is as follows:

Intercept:	.150
Birmingham AL:	-.052
Chicago IL	-.025
Los Angeles	.039
Washington DC	.59
Omaha NE	-.063

a. Other things being the same, how much higher or lower is the (DA/TA) ratio in Omaha as compared to Chicago? Explain.

b. If the reference group were changed from Atlanta to Chicago, what would be the new estimate of the coefficient on:

- i. the intercept term
- ii. the Atlanta dummy
- iii. the Omaha dummy.

Just provide the answer, no explanation is required here.

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<sup>2</sup> Mast, Brent; Benson, Bruce; and Rasmussen, David. "Entrepreneurial Police and Drug Enforcement Policy", mimeo, August 1997.

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3. (20 points) The regression analysis below was performed using STATA. The variable definitions are as follows:

smokpaks = number of packs of cigarettes smoked per month;  
age =years of age;  
educyrs =years of education;  
male =1 if person is male,=0 otherwise.

```
. sort male;  
. by male: summ smokpaks age educyrs;
```

-> male = 0

Variable	Obs	Mean
age	1605	55.69782
educyrs	1605	11.63614

-> male = 1

Variable	Obs	Mean
age	5418	56.95847
educyrs	5418	11.99022

```
. reg smokpaks age educyrs if male==1;
```

smokpaks	Coef.	Std. Err.	t
age	-.2596912	.0324445	-8.00
educyrs	-.3802783	.0490776	-7.75
_cons	25.94481	2.012668	12.89

```
. reg smokpaks age educyrs if male==0;
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smokpaks	Coef.	Std. Err.	t
age	-.1520891	.0797061	-1.91
educyrs	-.1402861	.0787958	-1.78
_cons	15.7352	4.652143	3.38

Use the above results to answer the following questions.

- What is the predicted level of smoking for a 40 year old male with 12 years of education? Explain.
- What is the difference between the average level of smoking between men and women? Explain.
- How much of the gender difference in smoking can be “explained” by the differences in education? Explain.
- How much of the gender difference in smoking can be “explained” by age and education combined? Explain.

4. (35 points) In a recent article<sup>3</sup>, Abigail Payne examines whether government transfers to nonprofit organizations “crowd out” private contributions. The theory is that, if government provides an additional \$1 to a nonprofit organization, private donations may be reduced. The following text drawn from the article describes the regression approach to testing the hypothesis:

The following model incorporates the variables discussed above:

$$D_{ijt} = \alpha + \beta Gov_{ijt} + \gamma Z_{jt} + \epsilon_{it} \quad (12)$$

where  $D_{ijt}$  is the real private donations received by non-profit firm  $i$  located in state  $j$  at time  $t$ ,  $Gov_{ijt}$  is the real government grants received by the non-profit and  $Z_{jt}$  represents the vector of political and/or economic measures for the state in which the non-profit is located. The crowd-out parameter is measured by  $\beta$ , the coefficient on government grants.

Using OLS to estimate the above equation,  $\beta$  is estimated to be -.0105 and the standard error of the coefficient estimate is .0030.

a. Based on the OLS estimate, what is the effect of an additional \$1 of government grants to a nonprofit on private donations? Is the effect statistically significant?

Payne notes a potential problem with the OLS estimates. *If private donations and government grants are jointly determined, then the latter are endogenous, biasing the measures of crowd-out.*” Payne experiments with a variety of identifying variables (instruments) and summarizes the results in the table on the next page.

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<sup>3</sup> Payne, A. Abigail (1998). “Does the government crowd-out private donations? New evidence from a sample of non-profit firms.” *Journal of Public Economics* 69 (3): 323-345.

Table 5  
 Relationship between private and public donations using two-stage least squares regression

Dependent variable		Government grants Stage 1 results	Private donations Stage 2 results	Residuals from stage 2 over- identification test	Hausman specification test
		(1)	(2)	(3)	(4)
Instruments used	Exogenous	<i>F</i> -stat on instruments	Coeff. on govt. grant	Chi-square statistic	<i>F</i> -stat on instruments
	Measures	( <i>P</i> -value)	(S.E.)	(df)	( <i>P</i> -value)
Individual transfers # 1	St. Econ #1 and St. Pol.	2.19 (0.0326)	-0.5327* (0.2022)	7.61 (6)	7.82 (0.0052)
Non-profit transfers # 1	St. Econ #1 and St. Pol.	0.06 (0.9450)	-1.2412 (4.8177)	1.01 (1)	0.21 (0.6468)
Non-profit transfers # 1 lagged	St. Econ #1 and St. Pol.	2.7700 (0.0631)	-0.7510 (0.4651)	0.00 (1)	2.61 (0.1066)
Individual transfers # 1 and non-profit transfers # 1	St. Econ #1 and St. Pol.	1.85 (0.0555)	-0.5773* (0.1984)	8.12 (8)	8.94 (0.0028)
Individual transfers # 1 and non-profit transfers # 1 lagged	St. Econ #1 and St. Pol.	2.56 (0.0063)	-0.4137* (0.1459)	11.41 (8)	7.54 (0.0061)
Individual transfers # 1 and non-profit transfers # 2	St. Econ #1 and St. Pol.	2.20 (0.0194)	-0.5398* (0.1660)	7.86 (8)	9.96 (0.0194)

Each row in the above table reflects the regression results using a different set of instruments. The first column represents the statistical significance of the relevant set of identifying variables in the first stage regression of 2SLS. The second column gives the estimates of  $\beta$  using the 2SLS approach. The third column represents the test of over-identifying assumptions discussed in class. The final column represents the results of a Hausman test for exogeneity of the government transfers variable.

- Compared to the OLS estimate of  $\beta$ , the 2SLS estimates are substantially larger (in absolute terms). What violation of the classical OLS assumptions could cause this? Be precise about which variables are the source of the problem and the sign of any relevant relationships.
- Given your answer in (b), if there are unobservables that cause private donations to a nonprofit to be larger, will the government provide more or less grants to a nonprofit? Explain.
- Based on the results presented, is there evidence for or against the hypothesis that government grants to nonprofits are exogenous to private donations? Explain.
- Notice that no p-values are provided for the over-identification tests. For the specification in row (1), should you reject the over-identifying assumptions? Describe how you came to this conclusion?
- Notice that the F-statistics in column (1) suggest that the various choices of instruments have considerably different explanatory power in the first stage regression (i.e. the p-values range from .006 to .95). Also, notice that the standard error of the estimate of  $\beta$  derived in the second stage (column 2) tends to drop as the aforementioned p-values drop. Given what you know about the determinants of the precision of 2SLS estimates, why should you have expected this relationship?

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